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Application No. 10/722,929
Attorney Docket No: 25226A

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IN THE CLAIMS

1. (Currently Amended) A method of manufacturing a rigid foam comprising:
incorporating nano-particles into a polymer melt, said nano-particles being selected from the group consisting of nano-clays, calcium carbonate, intercalated graphites and expanded graphites and having a particle size in at least one dimension less than 100;
incorporating a blowing agent into the polymer melt under a first pressure and at a first temperature;
extruding the polymer melt under a second pressure and at a second temperature, the second pressure and second temperature being sufficient to allow the polymer melt to expand and form a foam; and
cooling the foam to form a foam product having an average cell size, said average cell size being greater than approximately 60 μm and having a ~~menomedal~~ cell size distribution;
wherein said polymer melt includes an alkenyl aromatic polymer material.
2. (Currently Amended) A method of manufacturing a rigid foam according to claim 1,
wherein:
wherein the polymer includes a major portion of at least one alkenyl aromatic polymer selected from the group consisting of alkenyl aromatic homopolymers, copolymers of alkenyl aromatic compounds and copolymerizable ethylenically unsaturated comonomers.
3. (Currently Amended) A method of manufacturing a rigid foam according to claim 2,
wherein:
wherein the polymer includes a major portion of at least one alkenyl aromatic polymer selected from the group consisting of the polymerization products of styrene, α -methylstyrene, chlorostyrene, bromostyrene, ethylstyrene, vinyl benzene and vinyl toluene;
and
a minor portion of a non-alkenyl aromatic polymer.
4. (Currently Amended) A method of manufacturing a rigid foam according to claim 3,
wherein:
wherein the polymer includes at least 80 wt% polystyrene.

5. (Currently Amended) A method of manufacturing a rigid foam according to claim 2;
wherein:

wherein the blowing agent includes at least one composition selected from a group consisting of aliphatic hydrocarbons having 1-9 carbon atoms, halogenated aliphatic hydrocarbons having 1-4 carbon atoms, carbon dioxide, nitrogen, water, azodicarbonamide and p-toluenesulfonyl.

6. (Currently Amended) A method of manufacturing a rigid foam according to claim 5;
wherein:

wherein the blowing agent includes at least one composition selected from a group consisting of methane, methanol, ethane, ethanol, propane, propanol, n-butane, isopentane, carbon dioxide, nitrogen, water, azodicarbonamide, p-toluenesulfonyl, HCFC-142b and HCFC-134a.

7. (Original) A method of manufacturing a rigid foam according to claim 2, further comprising:

incorporating an additive into the polymer melt before forming the foam.

8. (Currently Amended) A method of manufacturing a rigid foam according to claim 7;
wherein:

wherein the additive includes at least one composition selected from a group consisting of flame retardants, mold release agents, pigments and fillers.

9. (Currently Amended) A method of manufacturing a rigid foam according to claim 2;
wherein:

wherein the nano particles have a minimum dimension of less than about 100 nm and said nano-clays are further selected from the group consisting of intercalated clays and exfoliated clays.

10. (Currently Amended) A method of manufacturing a rigid foam according to claim 9, wherein:

wherein the nano-particles are incorporated into the polymer melt at a rate of between 0.01 and 10 weight percent, based on polymer weight.

11. (Currently Amended) A method of manufacturing a rigid foam according to claim 9, wherein:

wherein the nano-particles are incorporated into the polymer melt at a rate of between 0.5 and 5 weight percent, based on polymer weight.

12. (Currently Amended) A method of manufacturing a rigid foam according to claim 11, wherein:

wherein the nano-particles include a major portion of nano-Montmorillonite (MMT); and

the polymer includes a major portion of polystyrene (PS), polyethylene (PE) or polymethyl methacrylate (PMMA).

13. (Currently Amended) A method of manufacturing a rigid foam according to claim 10, wherein:

wherein the nano-particles are formed by a technique selected from a group consisting of intercalation with polystyrene, in-situ polymerization of polystyrene (PS) or polymethyl methacrylate (PMMA) with a surface modified nano-Montmorillonite (MMT), and exfoliation of expandable graphite particles in a polystyrene or polymethyl methacrylate matrix.

14. (Previously Presented) A method of manufacturing a rigid foam according to claim 2, wherein:

the average cell wall thickness is less than about 10 μm ;
the average strut diameter is less than about 20 μm ;
the cell orientation is between about 0.5 and 2.0; and
the foam density is less than about 100 kg/m³.

15. (Original) A method of manufacturing a rigid foam according to claim 14, wherein:
the average cell size is between about 60 and about 120 μm ;
the average cell wall thickness is between about 0.2 and about 1.0 μm ;
the average strut diameter is between about 4 and about 8 μm ;
the cell orientation is between about 1.0 and about 1.5; and
the foam density is between about 20 and about 50 kg/m³.

16. (Original) A method of manufacturing a rigid foam according to claim 2, further comprising:

incorporating a conventional nucleation agent into the polymer melt at a rate of less than about 2 weight percent based on polymer weight.

17. – 20. (Canceled)

21. (Currently Amended) A method of manufacturing a monomodal-rigid foam comprising:

incorporating acicular nano-particles and at least one nucleating agent into a polymer melt, said nano-particles having a particle size in at least one dimension less than 100 ;
adding a blowing agent to said polymer melt under a first pressure and at a first temperature;
extruding said polymer melt under a second pressure and at a second temperature, said second pressure and said second temperature being sufficient to allow said polymer melt to expand and form a foam; and
cooling said foam to form a foam product having a monomodal cell size distribution;
wherein said polymer melt includes an alkenyl aromatic polymer material.

22. (Canceled)

23. (Previously Presented) The method of claim 21, wherein said foam has a cell orientation of at least about 1.2.

24. (Currently Amended) A method of manufacturing a rigid foam comprising:
incorporating nano-particles into a polymer melt, said nano-particles being selected from at least one nano-particle selected from calcium carbonate, intercalated-intercalated graphites[,] and expanded graphites;
adding a blowing agent and at least one nano-particle nucleating agent to said polymer melt under a first pressure and at a first temperature, said nano-particles having a particle size in at least one dimension less than 100 ;
extruding said polymer melt under a second pressure and at a second temperature, said second pressure and said second temperature being sufficient to allow said polymer melt to expand and form a foam; and
cooling said foam to form a foam product having an average cell size greater than about 60 µm;
wherein said polymer melt includes an alkenyl aromatic polymer material.